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ADSORPTION OF ERIOCHROME BLACK T (EBT) USING WOOD BARK ACTIVATED CARBON

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AUGUST 2024

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ABSTRACT

ADSORPTION OF ERIOCHROME BLACK T (EBT) USING WOOD BARK ACTIVATED CARBON

Water pollution is a serious environmental hazard, especially from industrial wastewater that contains heavy metals and synthetic dyes. Eriochrome Black T (EBT) is a common dye used in a variety of industries, and its presence in water bodies can have serious environmental and health consequences. This study investigates the usage of activated carbon produced from wood bark to adsorb EBT from aqueous solutions. Since synthetic dyes like EBT are widely used in industry, pollution and environmental damage are frequently caused when these dyes leak into water bodies. EBT is particularly difficult to remove from wastewater since it is a negatively charged dye, which makes treatment procedures more difficult and raises the possibility of environmental contamination. The main objectives were to assess the adsorption efficiency by varying adsorbent dosage, solution pH, initial dye concentration, temperature, and contact time, and to establish adsorption isotherm models (Langmuir, Freundlich, and Temkin) and kinetics. Batch adsorption study was conducted to observe the effect of different adsorption parameters on the adsorption capacity. Optimal conditions were identified as 0.1 g of adsorbent, 100 mg/L initial dye concentration, 120 minutes of contact time, and a solution pH of 4.5. The adsorption process was endothermic, with capacity increasing at higher temperatures. Detailed isotherm and kinetic studies provided deeper insights into the adsorption mechanism and behaviour. The equilibrium data analysis with Freundlich, Temkin, and Langmuir isotherm models revealed that the Langmuir model best fits the data. This indicates monolayer adsorption on a homogeneous surface, as evidenced by the R^2 = 0. 9848. Pseudo-first-order (PFO), pseudo-second-order (PSO), and Weber-Morris intraparticle diffusion (IPD) kinetic models were used to assess the kinetic parameters. The regression findings showed that a PSO model better represents the adsorption kinetics. Here's a more concise version of your sentence. However, the IPD model's q_t vs $t^{1/2}$ plot showed multi-linearity, indicating that adsorption occurred in multiple steps. Thermodynamic analysis at 25-34 °C showed the adsorption process is spontaneous and endothermic, with negative $\Delta G°$ and positive $\Delta H°$. The study offers insights for optimizing dye removal from water.

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